2 A Vision of the Future

Planning for the Library's future demands a forecast of the environment in which it will function. What sort of technology will be available for information management in the early part of the 21st century? What social and economic circumstances will underlie the provision of health care? How will the patterns of health professional education change? How will scientific work — research, communication, and decision making — be carried on?

Some parts of the future may be clearer than others. There is always uncertainty in prediction, but even an incomplete vision of the future can serve as a general guide for planning. The following scenario seeks to illuminate the ways in which information will be collected, organized, transferred, and used in the future.

Scenario 2006: An Industrial Accident

At a remote industrial plant in rural Virginia, where rocket fuel research had been performed in the 1950s and 60s, workers are detoxifying old cylinders containing unknown gases. Some gas is accidentally released, engulfing three men. The rescue squad and the company environmental protection officer are immediately summoned. By the time the air ambulances arrive, the men are gasping for breath. One experiences a violent convulsion followed by loss of spontaneous neurologic function. As the emergency medical technicians rush the men to the helicopters, the environmental protection officer samples the gases in the cylinders for assay in a gas chromatograph/mass-spectrograph. Within 20 minutes, 12 rescue workers, 2 bystanders and the officer are showing similar but milder symptoms. What is the gas and how toxic is it? What is the immediate treatment? Will there be long-term effects?

The air ambulance data analysis unit is fully equipped for video/voice/digital data communications and analysis. While one medical technician connects the men to monitoring systems and takes blood samples, another establishes communications links with the person performing the gas assay, the Toxicology Information Bank, and the receiving hospital. She reports the patients' signs and symptoms and the location of the accident. As she speaks, the computer simultaneously processes her words and the patients' physiologic data. The computer in the helicopter, which has received these data automatically from the auto-analyzer, makes

recommendations regarding the emergency treatment. When the gas chromatograph-mass spectrograph assay has been completed, the results are reported to the medical crew and the receiving hospital: probable B5H9 (pentaborane.) The computer recommends confirmatory studies, with complementary spectral analysis, when the patients reach the hospital. All these data become available while the air ambulance is en route.

The men's personal ID wallet cards, magnetically coded like bank cards, carry critical personal data including such health information as their medical history and baseline laboratory data. The cards are inserted into a special emergency reader, which unscrambles the privacy-protection code and displays the information, including a photograph and dental x-rays for positive identification. At the same time, an admission record is automatically created at the hospital. Immediate relatives are contacted automatically and told what is happening. The families arrive at the hospital shortly after the helicopters.

The hospital's decision support system recognizes pentaborane toxicity as the likely cause of the syndrome and automatically searches its files for similar cases. It finds none, but the Hazardous Substances Data Base at the National Library of Medicine identifies three cases, reported in the literature 10 years earlier. In that incident, one patient died on the way to the hospital. His autopsy report documented widespread damage to the central nervous system. The other two victims recovered during the first week, with few residual effects. Several animal studies in the data base report selective reaction of pentaborane with nervous tissue.

In the emergency room, the physician in charge and two residents have been observing the emergency crew at work. Information from the helicopter has been transmitted to the emergency room's video monitor and personal computer workstations, which are the size and shape of the clipboards the doctors once used for note taking and record keeping. Two of the patients have required blood pressure and ventilatory support. One patient has just gone into cardiac arrest. Eighteen people have been exposed; it appears that at least two will die.

Because no information is available on long-term effects, the hospital's decision support system establishes an individualized follow-up protocol for everyone involved. With the same terms and search procedures used to search the Hazardous Substances Data Base and the hospital's decision support system, the medical librarian calls up the National Library of Medicine's literature search system. Three relevant articles are immediately available in full text on the computer screen for the physician's scrutiny. Though the emergency room is quietly tense, the treatment team is now as fully informed as possible about the probable cause, optimal treatment, and likely outcome of the patients the helicopters are rushing to their care.

Four months after the disaster, the internist assesses the damage. One patient — the man who initially lost neurologic function — never recovered consciousness and died on the eighth day. Another is quadriplegic, blind, partially deaf, and no longer sentient. The third man has been luckier: He had been the farthest away and had been able to cover his face and hold his breath. Twelve weeks after the accident, he and seven others who were exposed still evidence mild brain dysfunction and psychiatric symptoms. The fact that these findings are not consistent with earlier data in the Hazardous Substances Data Base, is not surprising. Post-trauma monitoring was not as easy and sophisticated 10 years ago, when the previously reported accident had occurred.

The internist, the emergency room physician, and a nurse epidemiologist have asked the victims to take part in a long-term follow-up study. Most agree because participation requires their coming to the hospital only one day a year, for physical examinations and biochemical assays. Other data (such as psychological performance) can be collected over the phone after voice prints have been made. The patients will be called and interviewed by a computer program that is both polite and able to answer their questions.

The nurse-epidemiologist makes home visits part of his routine follow-up protocol. His clipboard workstation is equipped with a microrecorder that tapes all interviews. A

pressure-sensitive screen allows him to follow the interview guide and code the responses easily. Later, the stored responses are "uploaded" to a machine "trained" to accept both voice and digital input. A series of programs presort the information for later review by the research team. The data are compiled and available in the Toxicology In-

formation Bank, labeled as preliminary because additional data are still coming in. Toxic spills are still not commonplace, but far too many hazardous chemicals were buried years ago to be sure the data won't be needed again.

At home, one of the patients is glad to see the nurse. Neither he nor his wife was confident about the details of his treatment and what he had to do. The nurse shows them how to use a small computer, about the size of a book, that he plans to leave with them. It takes its program from a compact digital video disk that includes moving pictures showing the patient how to care for himself. Everyday, it lists what needs to be done. When the patient finishes a procedure, all he needs to do is run a finger across the instruction. If the patient forgets, the next day the instruction will flash. And if he skips a procedure more than once, the computer will alert a visiting nurse to call.

If nothing is done for more than a day, an emergency alert will contact the hospital medical information system. If the couple needs something explained, all they have to do is activate the 'Help Panel.' The computer can distinguish between an urgent need for help and a reminder or information need. If the need is urgent, the call is immediately referred to a nurse or a physician. Otherwise, the appropriate instruction is displayed on the screen. The instructions are resident in the computer's disk memory. The computer can also be used to contact the patient's physician and to get prescriptions renewed.

The patient settles back, reassured by the skill and technology available to him. In time, he makes a full and uneventful recovery.